Climate risks in the water sector: Advancing the readiness of emerging technologies in climate downscaling and hydrologic modeling.

Completed Technology Project (2017 - 2019)

Project Introduction

Objectives and benefits: Many water resources planning decisions require understanding the vulnerability of hydrologic systems to a wide range of different stresses. For many users, this requires developing a set of discrete quantitative hydrologic storylines of climate change impacts that can be used to evaluate adaptation measures. Quantitative hydrologic storylines rely on modern climate downscaling tools and process-based hydrologic models. Each storyline represents key features from the full range of possible climate scenarios, and, taken together, the storylines provide a comprehensive yet concise description of possible climate change impacts. The research community has made substantial scientific advances in understanding impacts of climate variability and change on water resource systems; however, the technologies in climate downscaling and hydrologic modeling have considerable unrealized potential and lack sufficient technical readiness to be used widely for water resources planning. The goal of this proposed project is to increase the value of emerging science advances in climate downscaling and hydrologic modeling for water resources planning. This proposed work will provide tools and data resources for both researchers and practitioners to better manage current climate risk, reveal future climate change risks, and more effectively evaluate future change and adaptation options. Outline of the proposed work and methodology: We propose to increase the readiness of emerging technologies in climate downscaling and hydrologic modeling by extending the NASA Land Information System (NASA-LIS) to evaluate climate-related risks in the water sector. The specific work elements in the proposal are: 1. Advance climate downscaling tools to provide climate change scenarios for input to NASA-LIS, including capabilities to explore sensitivities to downscaling methodological choices; 2. Develop watershed-based hydrologic model configurations, and implement them in NASA-LIS, to define land model configurations for water-resource planning; 3. Refine hydrologic models to improve the fidelity of hydrologic model simulations, using a suite of remotely sensed data for diagnostic assessment and improvement as well as bias correction of simulated streamflow time series; 4. Tailor model outputs to increase applicability of hydrologic climate change scenarios for water resources planning, using interactive web-based tools and summary products; and 5. Apply advanced concepts of information theory and machine learning to identify process-level tradeoffs between modeling options, and guide priorities for future research investments. We will accomplish the work elements in this proposal by extending and applying new community models and methods for climate downscaling and hydrologic modeling developed jointly by the Computational Hydrology groups at the National Center for Atmospheric Research and the University of Washington (see https://ral.ucar.edu/hap/computational-hydrology). Period of performance: September 1st 2017 – August 31st 2019. Technical Readiness Level Advancement: Entry TRL: 3; Exit TRL: 6.

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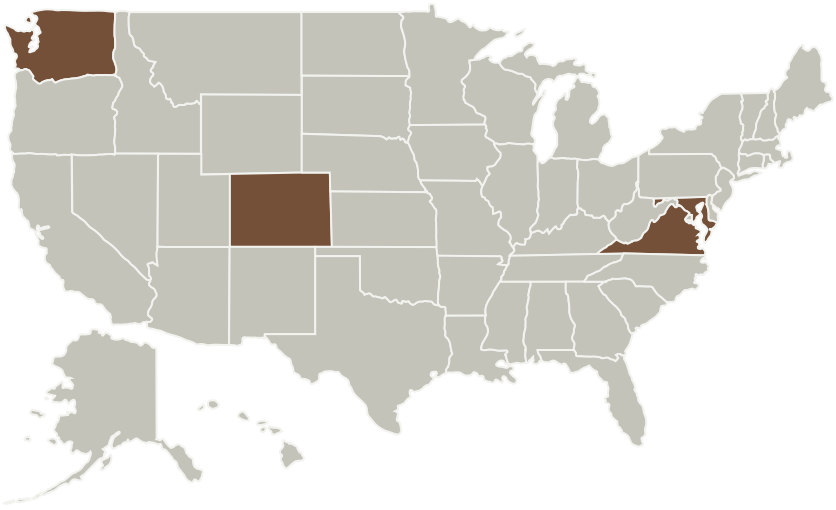
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University Corporation for Atmospheric Research(UCAR)	Lead Organization	Academia	Boulder, Colorado

Primary U.S. Work Locations	
Colorado	Maryland
Virginia	Washington

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

University Corporation for Atmospheric Research (UCAR)

Responsible Program:

Advanced Information Systems Technology

Project Management

Program Director:

Pamela S Millar

Program Manager:

Jacqueline J Le Moigne

Principal Investigator:

Martyn P Clark

Co-Investigators:

J Arnold
Grey S Nearing
Bart Nijssen
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Kristi R Arsenault
Christa D Peters-lidard
Sujay V Kumar
Jeff Wild

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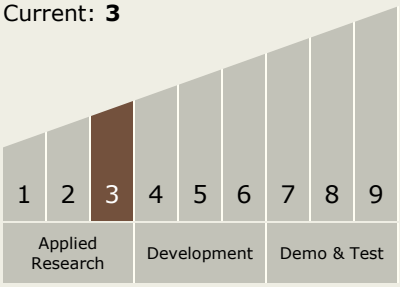
Technology Maturity (TRL)

Start: **3**
Current: **3**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.2 Modeling
    - TX11.2.3 Human-System Performance Modeling

Target Destination

Earth